



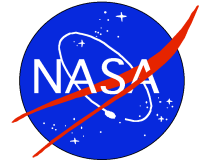
Section 5.0

Requirements Overview

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Outline

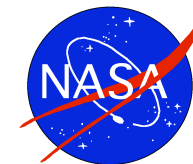


- ▶ ***Requirements Definition***
- ▶ ***Requirements Tree***
- ▶ ***Requirements Document***
- ▶ ***Requirements Criticality***
- ▶ ***Key Requirements***

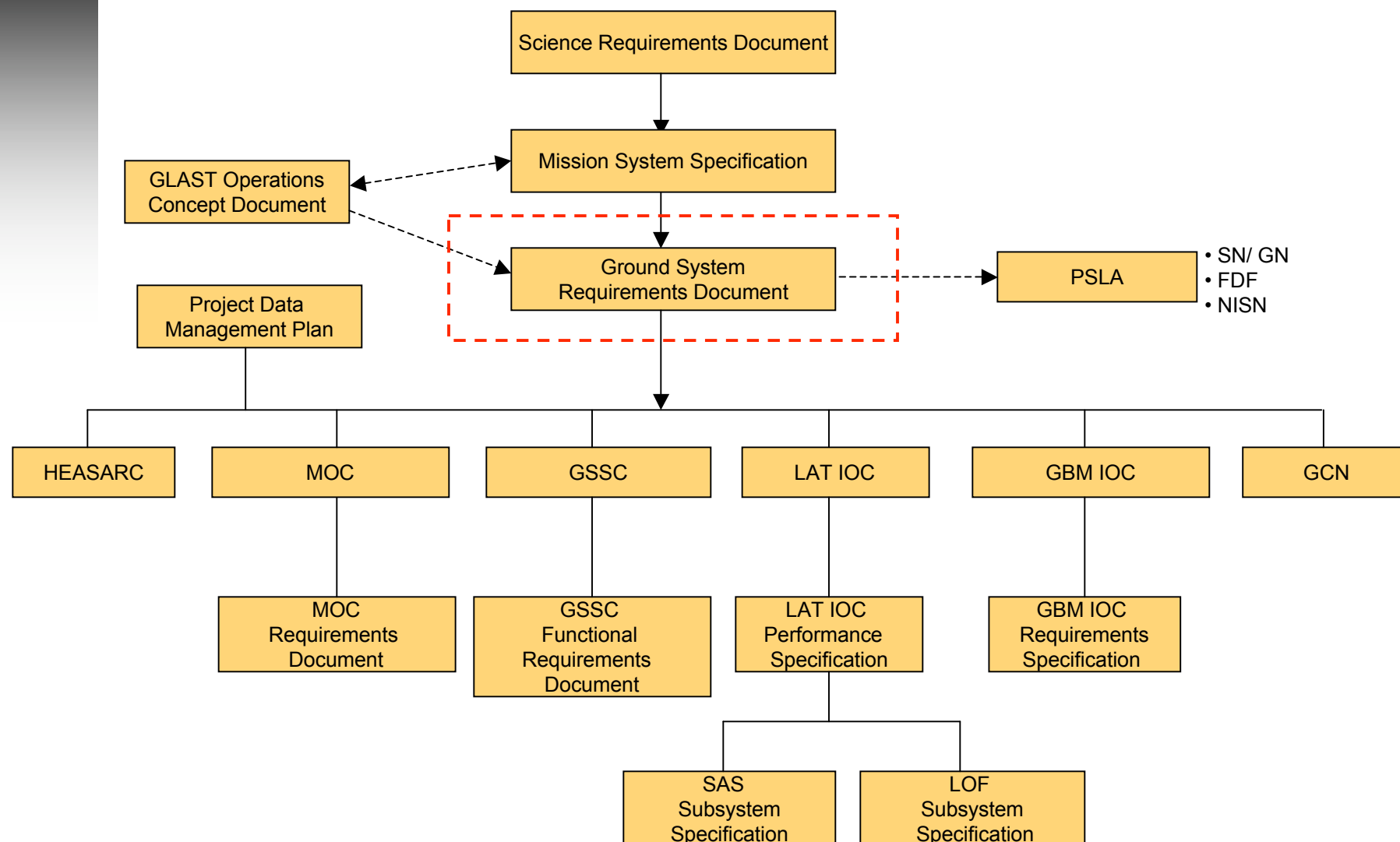


Requirements Definition Approach

- ▶ ***High level requirements defined in the Science Requirements (Level 1) Document and the Mission Systems Specification (Level 2)***
- ▶ ***Context provided by the Operations Concept Document***
- ▶ ***Requirements (Level 3) for ground system defined in the Ground System Requirements Document (GSRD)***
 - *Comprised of System-level requirements that apply to multiple or all elements, and requirements for each ground system element*
 - *Includes: SN, GN, Communications, MOC, FDF, LAT IOC, GBM IOC, SSC, HEASARC, GCN, Spacecraft I&T Facility, KSC*
 - *Will also be entered into Project's Requirements Data Base (DOORS)*
- ▶ ***These represent the set of requirements that will drive the Ground System Test Program***
- ▶ ***Each element will have a set of element-level (Level 4) requirements that will trace to the GSRD***
 - *IOC's will also trace to other documents for their role in instrument I&T*
 - *GSSC has science support requirements that trace directly to the SRD and MSS, and that are driven by the Project Data Management Plan (PDMP)*



Requirements Tree





Ground System Requirements Document



- ▶ ***GSRD is organized by element/function***
 - *System – applies to three or more elements*
 - *Element – such as SN, MOC, GSSC, LIOC, FDF*
 - *Each section organized by subtopics*
 - *Example for MOC: Facility, Security, RMA, Interface, Planning & Scheduling, Telemetry & Command Processing, Data Processing, Offline Processing, Automation, Support*
- ▶ ***Requirements documented in table format to facilitate conversion to a verification matrix, with columns for:***
 - *Requirement Number*
 - *Requirement Text*
 - *Requirement Clarification/Comment*
 - *Requirement Trace (Source and Source ID)*



Requirements Criticality

- ▶ ***Ground system functions that are launch critical have been documented in the GSRD***
 - *Helps to ensure that while the entire ground system is being designed, implemented and tested before launch, there is a mechanism to focus priorities on what is required for launch if necessary (e.g., prioritizing discrepancies)*
 - *Launch critical means that the capability is required in order to launch the observatory (i.e., support launch and early orbit activation and achieve some basic science)*
- ▶ ***Requirements in GSRD will be assigned a “launch criticality” indicator based on if they apply to a function that is considered launch critical***
- ▶ ***Launch criticality will be assigned in the GSRD Requirements Verification Matrix (under GS CCB control)***



Launch Critical Functions

- ▶ *Provide ground station X and S-band and SN S-band communications with the observatory*
- ▶ *Acquire, receive and archive observatory science and housekeeping data*
- ▶ *Process and display observatory housekeeping data*
- ▶ *Recognize, identify, and log observatory alarm conditions*
- ▶ *Perform observatory engineering analysis*
- ▶ *Generate and uplink real-time observatory commands via command scripts*
- ▶ *Generate and uplink observatory stored command loads*
- ▶ *Dump and manage recorded observatory housekeeping and science data*
- ▶ *Generate and uplink observatory memory loads*
- ▶ *Initiate and process observatory memory dumps*
- ▶ *Perform Level 0 processing on observatory science and HK data*



Key Requirements

- ▶ ***Support highly autonomous mission operations that enables lights-out operations approach***
 - *Automated pass operations (including SSR dumping)*
 - *Automated data handling/processing*
 - *Automated telemetry monitoring, alarm detection, and operator paging*
 - *Support operators with remote access to data/displays*
- ▶ ***Generate science data products (Level 1) within 72 hours of initial detection on-board by instrument***
 - *36 hours space to ground*
 - *12 hours ground station to LAT IOC (through MOC)*
 - *24 hours for LAT IOC to generate Level 1 products*
- ▶ ***Provide ability to support science observation planning, and to translate this planning into on-board activities/commands***
- ▶ ***Provide Burst Alerts from spacecraft to GCN within 7 seconds***
- ▶ ***Provide ability to respond to TOO Requests within 6 hours***



Key Requirements

- ▶ ***Support CCSDS for telemetry (Series 100 Blue Books) and command (Series 200 Blue Books) data***
- ▶ ***Capture 98% of the science and housekeeping data***
- ▶ ***Ensure ground system meets NASA IT Security requirements (i.e., must be NPG 2810.1 compliant)***



RMA Requirements

- ▶ ***Provide reliability of .9998 for ground system components supporting critical real-time operations***
 - *Applies to SN, GN, Ground Communications, MOC*
- ▶ ***Provide ability to fail over to a backup system within 1 minute for ground system components supporting critical real-time operations***
- ▶ ***Provide ability to bring failed prime system back online within 12 hours of for ground system components supporting critical real-time operations***
- ▶ ***Ensure no single point of failure exists for for ground system components supporting critical real-time operations***